Strait of Georgia Juvenile Herring Survey, 2004

M. Thompson, and C. Hrabok

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

2007

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2821

Fisheries and Oceans | Pêches et Océans

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 1426 - 1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques ques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports manuscrits sont produits a l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

2008-01999/

Canadian Manuscript Report of

Fisheries and Aquatic Sciences 2821

2007

STRAIT OF GEORGIA JUVENILE HERRING SURVEY, 2004

by

M. Thompson and C. Hrabok

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

©Her Majesty the Queen in Right of Canada, 2007

Cat. No. Fs 97-4/2821E ISSN 0706-6473

Correct citation for this publication:

Thompson, M., and Hrabok, C. 2007. Strait of Georgia juvenile herring survey, 2004. Can. Manuscr. Rep. Fish. Aquat. Sci. 2821: v + 31 p.

TABLE OF CONTENTS

ABSTRACT v
RESUME v
INTRODUCTION 1
METHODS 1
RESULTS 3
CONCLUSION 4
ACKNOWLEDGMENTS 4
REFERENCES 5

LIST OF FIGURES

Figure 1. The five major British Columbia herring stock assessment areas with the Strait of Georgia being the study area.....6

Figure 2. Strait of Georgia 2004 purse seine set locations (n=45). Transect numbers shown.....7

Figure 3. Strait of Georgia 2004 plankton tow locations (n=29). Transect numbers shown.....8

Figure 4. Length-frequency distribution for all 2004 sampled herring (n=5292).....9

Figure 5. Length-frequency histograms by transect for 2004.....10

Figure 6. Length-weight relationship for all 2004 sampled herring (n=5292).....14

LIST OF TABLES

Table 1. Summary of all 2004 Strait of Georgia purse seine sets.....15

Table 2. Species number and weight by transect and station for 2004 (trace = ≤ 9g)....16

Table 3. Percent species occurrence in purse seine sets for 2004.....23

Table 4. Number sampled, size range, mean length, mean weight, weight range and standard deviations for all three observed age classes. Total catch in numbers and total catch weight of all herring by transect for 2004.....24

Table 5. Categories of organisms, by phylum, identified in plankton tows.....26

Table 6. Calanoid, cyclopoid and harpacticoid copepods identified in 2004 plankton samples.....27

Table 7. Zooplankton density per set in number of organisms per m^3 of water sampled for 2004.....28

ABSTRACT

Thompson, M., and Hrabok, C. 2007. Strait of Georgia juvenile herring survey, 2004. Can. Manuscr. Rep. Fish. Aquat. Sci. 2821: v + 31 p.

In 2004, a Strait of Georgia juvenile herring survey was conducted from September 23 to October 3. Forty-five purse seine sets were made at ten core transect locations within Trincomali Channel in the south to Smelt Bay in the north. The survey monitors the distribution and relative abundance of young of the year herring in the Strait of Georgia as a predictor of recruitment to the spawning stock and fishery at age-3 in the future.

Twenty-seven species of fish were identified in the purse seine catches with herring being the most frequently encountered species. A total of 5292 herring were measured resulting in a length frequency distribution that was distinctly bimodal representing age-0+ and age-1+ fish. Age-0+, age-1+ and age-2+ or older herring occurred in 82.2%, 28.9% and 11.1% of the sets, respectively. Twenty-nine oblique plankton tows were performed during the survey. Barnacle larvae, *Corycaeus anglicus,* unidentifiable calanoid copepods and larvaceans (*Oikopleura sp.*, *Fritillaria sp.*) were the most prominent zooplankters.

RESUME

Thompson, M., and Hrabok, C. 2007. Strait of Georgia juvenile herring survey, 2004. Can. Manuscr. Rep. Fish. Aquat. Sci. 2821: v + 31 p.

Du 23 septembre au 3 octobre 2004, un relevé des harengs juvéniles a été mené dans le détroit de Georgia. Quarante-cinq coups de senne coulissante ont été effectués le long de dix transects centraux, depuis le chenal Trincomali jusqu'à la baie Smelt. Le relevé permet de surveiller la répartition et l'abondance relative des jeunes harengs de l'année dans le détroit de Georgia, variables qui sont des prédicteurs du recrutement à l'âge 3 au stock de géniteurs et à la pêche.

Vingt-sept espèces de poissons ont été identifiées parmi les captures à la seine coulissante; le hareng était l'espèce la plus fréquemment trouvée. Un total de 5 292 harengs ont été mesurés, et la répartition des fréquences de longueur était distinctivement bimodale, représentant les poissons d'âge 0+ et d'âge 1+. Les harengs d'âge 0+, d'âge 1+ et d'âge 2+ ou plus correspondaient respectivement à 82,2 %, 28,9 % et 11,1 % des poissons observés dans les coups de senne. Vingt-neuf traits obliques de filet à plancton ont été réalisés pendant le relevé. Les larves de *Corycaeus anglicus,* des copépodes calanoïdes non identifiés et les larvacés (*Oikopleura* sp., *Fritillaria* sp.) étaient les zooplanctontes dominants.

INTRODUCTION

Pacific herring (*Clupea pallasi*) are an important commercial and vital forage species for many marine mammals, birds and other fish in British Columbia's coastal waters. Herring spawn principally on marine vegetation in the upper subtidal and intertidal zones between February and June, with peak spawning occurring between March and April (Humphreys and Hourston 1978). Larvae hatch in two to three weeks, and disperse with surface currents, metamorphosing into juvenile herring at a length of ~25mm (Hourston and Haegele 1980). Herring are considered juvenile until they are three years of age and have joined the sexually mature spawning population (Hay and McCarter 1999). During daylight hours, juvenile herring congregate in schools, occasionally forming mixed aggregates with other pelagic species, close to shore near the bottom (Haegele 1997). At dusk, these fish migrate into surface waters to feed on plankton. During this time they are vulnerable to purse seine gear.

Purse seine surveys to determine the distribution and abundance of juvenile herring in the Strait of Georgia have been conducted annually since 1990, except for 1995 (Figure 1). The main objective of the survey was to estimate the density and relative abundance of the juvenile herring population as a potential indicator of recruitment before they have joined the spawning stock. In addition to recruitment prediction, the surveys have contributed to a better understanding of the distribution, abundance, and ecological role of herring in the Strait of Georgia.

METHODS

The fall Strait of Georgia juvenile herring survey for 2004 (Figure 2) monitored the ten core transects (1 – 6, 8 – 11); which are made up of 48 sampling stations and have been sampled consecutively since 1990 (except 1995). These ten core transects are used in the juvenile herring recruitment prediction (Hay et. al. 2003). The sampling sites originally were chosen based on known historical herring spawning sites, and represent both nearshore and open water habitats (Haegele et. al. 2005). In 2004, sampling was conducted from September 23rd to October 3rd (Table 1). A total of 45 of the 48 core stations were sampled. Two sets were performed in Henry Bay (Transect 4, Station 1 and 3) which resulted in to many jellyfish to get a representative herring sample; therefore the transect could not completed.

Fish Sampling

The 12m, aluminium-hulled Fisheries Research Vessel *Walker Rock* was used for all fishing events. A 183m long and 27m deep purse seine net of knotless web, resulting in an area fished of ~2665m^2, was used for all fishing events. The body of the net had 46m of 22.2mm mesh at the tow end followed by 91m of 19.0mm mesh, and the bunt end was 46m of 9.5mm mesh. The net fished to a depth of 10m, and was able to retain fish

greater than 20mm in length. All sets were made after dusk when herring are feeding near the surface. All sets were made "blind" at the predetermined sampling stations. Up to five sets were completed per night, depending on location. For most sets, it was possible to land the entire catch for biological sampling. On occasion, it was not practical to land a large set in its entirety, so sub-sampling was necessary. When sub-sampling was required, a 40kg tote was filled with randomly selected fish and retained for biological sampling. Several dipnet samples from various parts of the net (catch) would be used to make up the random sub-sample. The remainder of the set was released over the corkline, its size estimated as the number of totes released. The number of herring caught in each set was determined by dividing the total catch weight by the mean weight of sub-sampled herring. The number of other species caught was determined in the same manner (Tables 2). All fish retained for sampling were bagged and preserved in a 3.7% seawater formalin solution, with the exception of large predator species (e.g. adult salmon and flatfish). These fish were individually measured in the field. All retained fish were later sampled in the laboratory at the Pacific Biological Station within two weeks of capture. From each set, 200 or more herring and all other fish species caught were identified, weighed and measured. If the set contained less than 200 herring, then all herring were weighed and measured. Consistent with standard practices, herring were measured to standard length, salmon to fork length and groundfish to total length; all to the nearest millimeter. All other fish species were measured to standard length.

Plankton Sampling

Twenty-nine stepped oblique plankton tows were performed during the survey (Figures 3). The tows always were completed after dusk and immediately before the fishing events. At least one nearshore and one offshore tow location were sampled for all transects. Dual 19cm diameter bongo nets with 350μm mesh were used for sampling, resulting in 'left' and 'right' bongo plankton samples (only left samples were processed). The bongos were lowered to 20m (10m in shallow areas) and raised by an electric winch at a rate of 1m every 15sec (or 1m every 30sec for shallow areas). A General Oceanics® 2030R model flowmeter was attached to the left bongo to determine the volume of seawater filtered. Volume filtered was calculated using the following equation (McCarter and Hay 2002):

$$\mathbf{V = (A \cdot F \cdot K) / 999{,}999}$$

Where:

V = volume of water filtered through the plankton net (m^3)
A = area of net opening ($0.02835 m^2$)
F = number of revolutions recorded by the flow meter (m)
K = standard speed rotor constant for 7cm rotor (26,873)

Upon retrieval, the bongo nets were washed with a high pressure deck hose, and the samples preserved in 3.7% seawater formalin.

In the laboratory, a volumetric splitter was used to reduce the sample size to a point where organisms could be conveniently counted and identified in a counting tray using a

stereo microscope under 30X magnification. Sample splitting continued until a target size of roughly 300 organisms was reached (Thompson et al. 2003).
Plankters were identified to the lowest taxonomic level. Copepods were identified to species. Densities for all plankters were determined and expressed as plankters · m^{-3}.

RESULTS

Herring

Forty-five stations were sampled from Transects 1 – 6, 8 – 11. A total of 5292 herring were weighed and measured resulting in a length frequency distribution that was distinctly bimodal (Figure 4). Three length designations for the juvenile herring age-classes were produced:

0+ = herring less than or equal to 120mm standard length
1+ = herring between 121mm and 156mm standard length
2+ and older = herring greater than or equal to 157mm standard length

Age-0+ herring occurred in 82.2% of the stations (Table 3). The mean length and weight for age-0+ herring was 93mm and 9.8g respectively. A total of 115038 age-0+ were caught for a total weight of 985.56kg (Table 4).

Age-1+ herring occurred in 28.9% of the stations (Table 3). The mean length and weight for age-1+ herring was 134mm and 32.6g respectively. A total of 210 age-1+ herring were caught for a total weight of 7.12kg (Table 4).

Age-2+ herring occurred in 11.1% of the stations (Table 3). The mean length and weight for age-2+ herring was 177mm and 75.1g respectively. A total of 41 age-2+ herring were caught for a total weight of 2.71kg (Table 4).

Length frequency histograms by transect location for all sampled herring are shown in Figure 5. Most transects were dominated by a single age-class, mainly being age-0+ herring. The majority of these fish being caught in Yellow Point (Transect 2), Atrevida Reef (Transect 9) and Cape Cockburn (Transect 10). A length-weight relationship for all sampled herring from the survey showed a positive correlation coefficient (r) of 0 .9395 (Figure 6).

Plankton

There were 20 categories of organisms identified in 29 plankton samples (Tables 5 and 6). An average of 13.4399m^3 of water was filtered per plankton tow. Copepods occurred in all samples. *Corycaeus anglicus* and larvaceans (*Oikopleura sp., Fritillaria sp.*) were the only organisms to occur in all samples. Amphipods, barnacle larvae, *Corycaeus anglicus*, medusae (*Aequorea victoria*), gastropods, larvaceans (*Oikopleura sp.,*

Fritillaria sp.), *Paracalanus parvus*, shrimp larvae, siphonophores and unidentifiable calanoid copepods made up >75% of sampled organisms.

CONCLUSION

Forty-five stations were sampled resulting in 27 different fish species recorded from purse seine sets. A total of 5292 herring were measured and weighed creating a distinct bimodal histogram representing three juvenile herring age groups. Twenty-nine plankton tows were performed resulting in *Corycaeus anglicus* and larvaceans (*Oikopleura sp., Fritillaria sp.*) being the predominant organisms by occurrence and barnacle larvae being the predominant organism by quantity.

ACKNOWLEDGMENTS

This survey was funded by the Herring Conservation and Research Society (HCRS) and the Department of Fisheries and Oceans. The survey could not have been possible without the hard work of skipper Bob Armstrong and crew member Dennis Chalmers. Plankton samples were processed by Zotec services.

REFERENCES

Haegele, C.W. 1997. The occurrence, abundance and food of juvenile herring and salmon in the Strait of Georgia, British Columbia in 1990 to 1994. Can. Manuscr. Rep. Fish. Aquat. Sci. 2390: 124 p.

Haegele, C.W., Hay, D.E., Schweigert, J.F., Armstrong, R.W., Hrabok, C., Thompson, M., and Daniel, K. 2005. Juvenile herring surveys in Johnstone Strait and Georgia Straits – 1996 to 2003. Can. Data Rep. Fish. Aquat. Sci. 1171:xi + 243 p.

Hay, D.E., Schweigert, J.F., Thompson, M., Haegele, C.W., and Midgley, P. 2003. Analyses of juvenile surveys for recruitment prediction in the Strait of Georgia. Can. Sci. Advis. Sec. Res. Doc. 2003/107: 28 p.

Hay, D.E., and McCarter, P.B. 1999. Age of sexual maturation and recruitment in Pacific herring. Can. Sci. Advis. Sec. Res. Doc. 99/175: 42 p.

Humphreys, R.D., and Hourston, A.S. 1978. British Columbia herring spawn deposition survey manual. Fish. Mar. Serv. Misc. Spec. Publ. 38: 40 p.

Hourston, A.S., and Haegele, C.W. 1980. Herring on Canada's Pacific coast. Can. Spec. Publ. Fish. Aquat. Sci. 48: 23 p.

McCarter, P.B., and Hay, D.E. 2002. Eulachon embryonic egg and larval outdrift sampling manual for ocean and river surveys. Can. Tech. Rep. Fish. Aquat. Sci. 2451: 33 p.

Thompson, M., Hrabok, C., Hay, D.E., Schweigert, J., Haegele, C., and Armstrong, B. 2003. Juvenile herring surveys: methods and data base. Can. Manuscr. Rep. Fish. Aquat. Sci. 2651: 31 p.

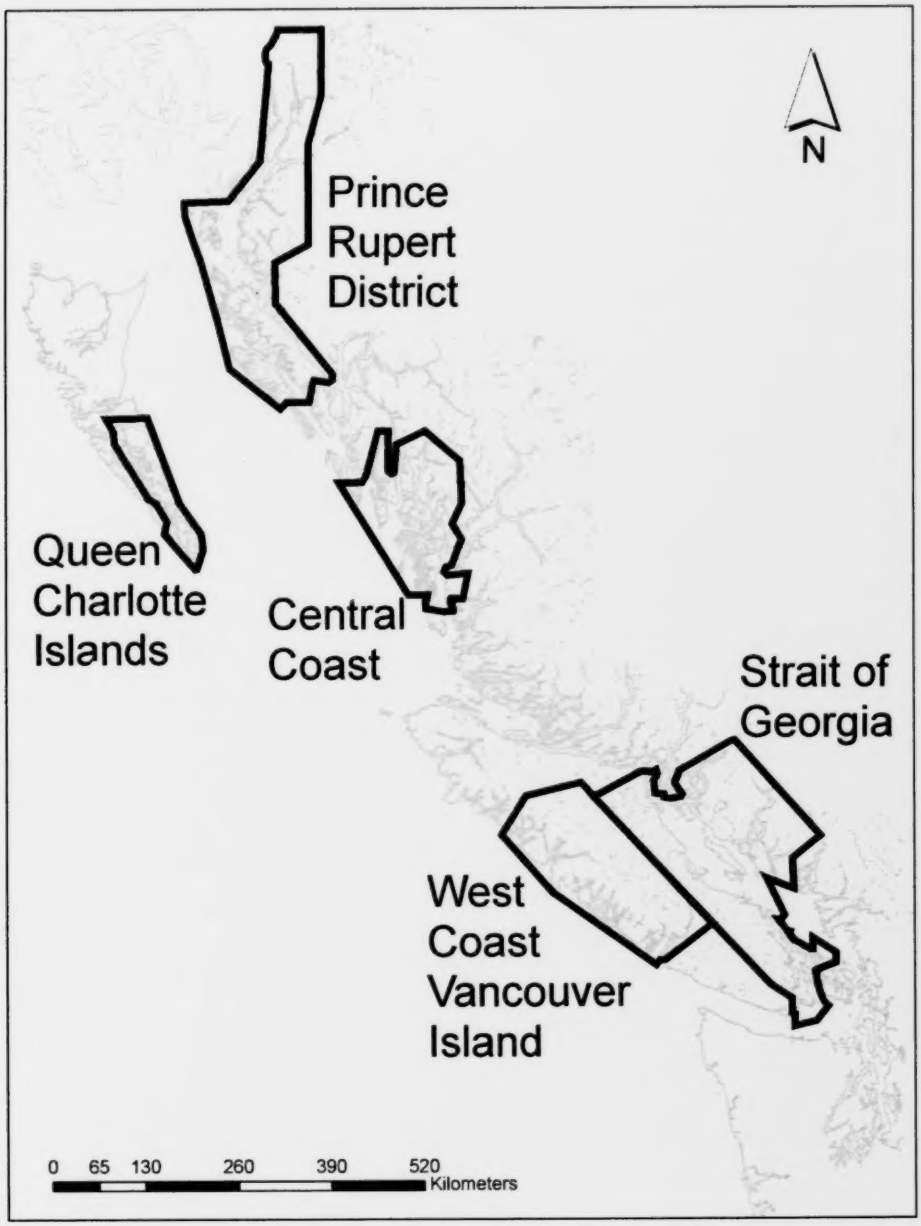


Figure 1. The five major British Columbia herring stock assessment areas with the Strait of Georgia being the study area.

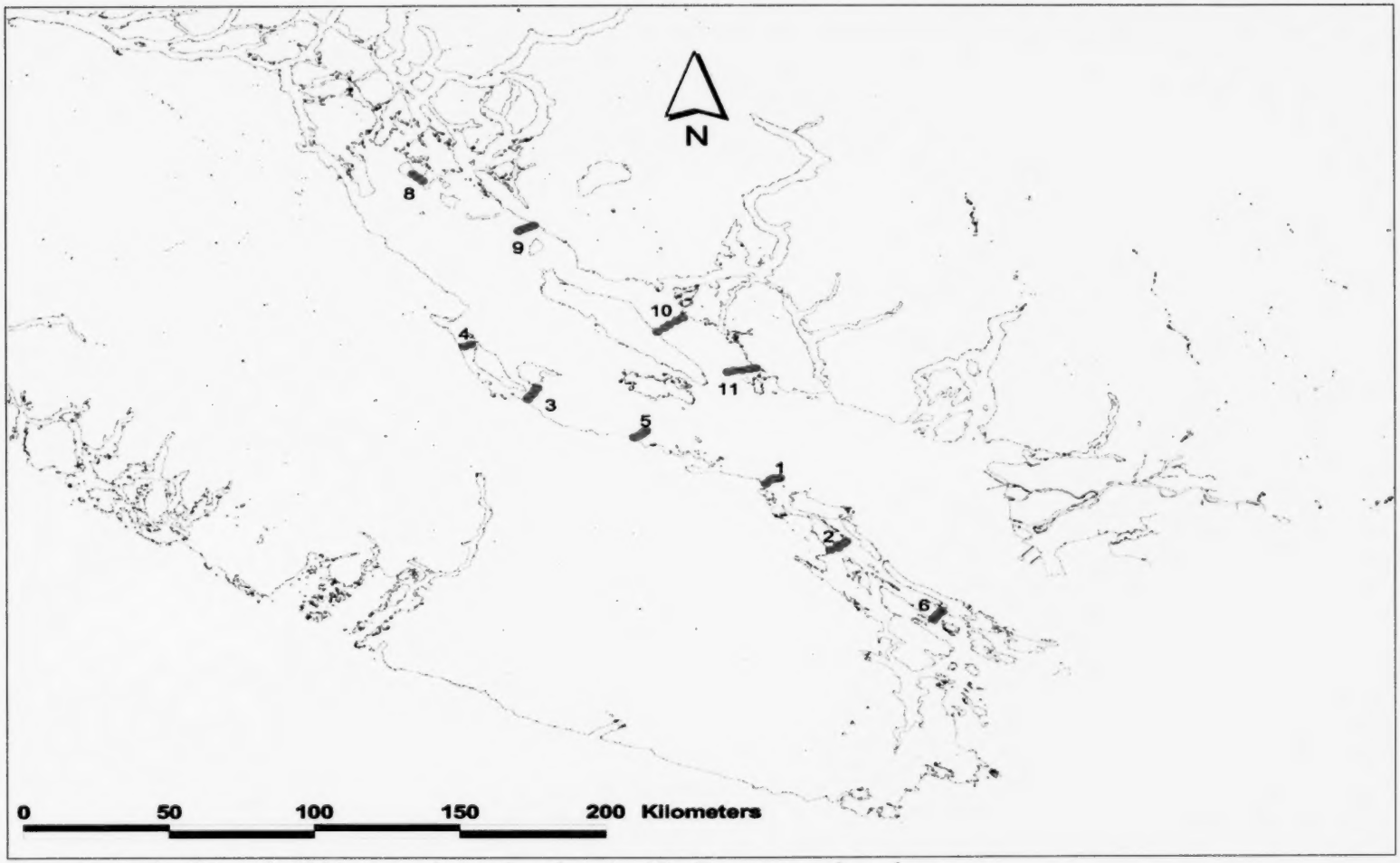


Figure 2. Strait of Georgia 2004 purse seine set locations (n=45). Transect numbers shown.

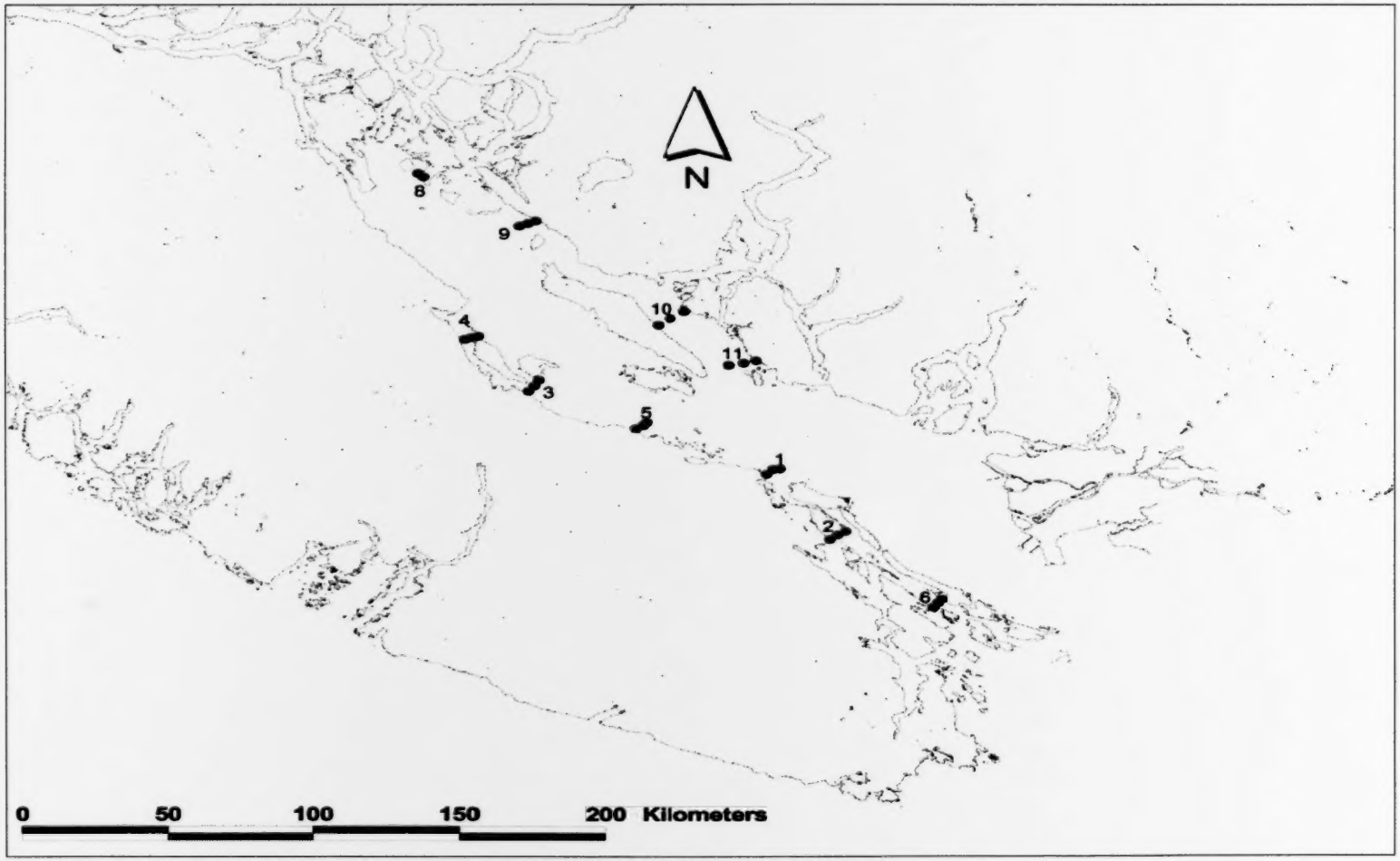


Figure 3. Strait of Georgia 2004 plankton tow locations (n=29). Transect numbers shown.

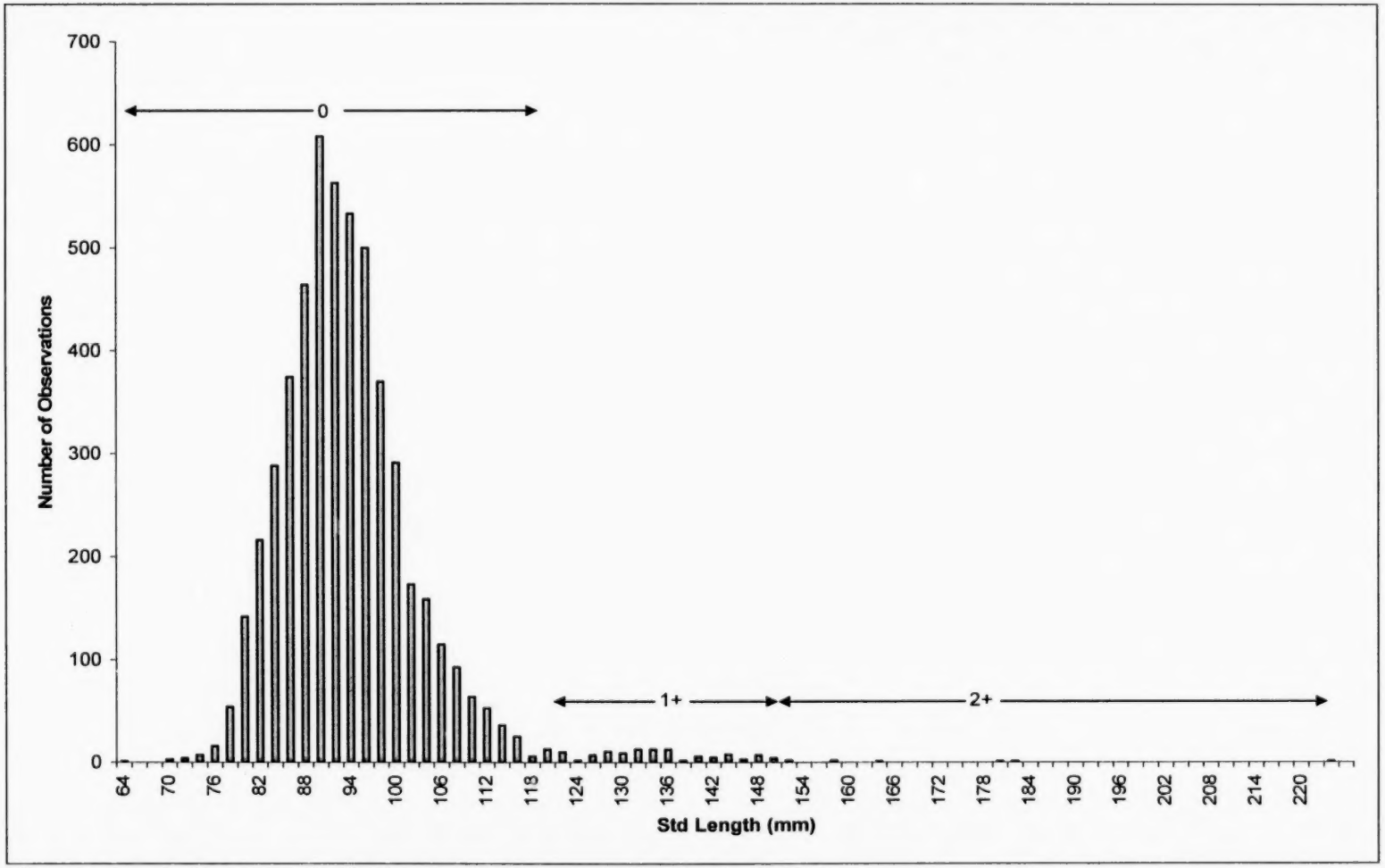


Figure 4. Length-frequency distribution for all 2004 sampled herring (n=5292).

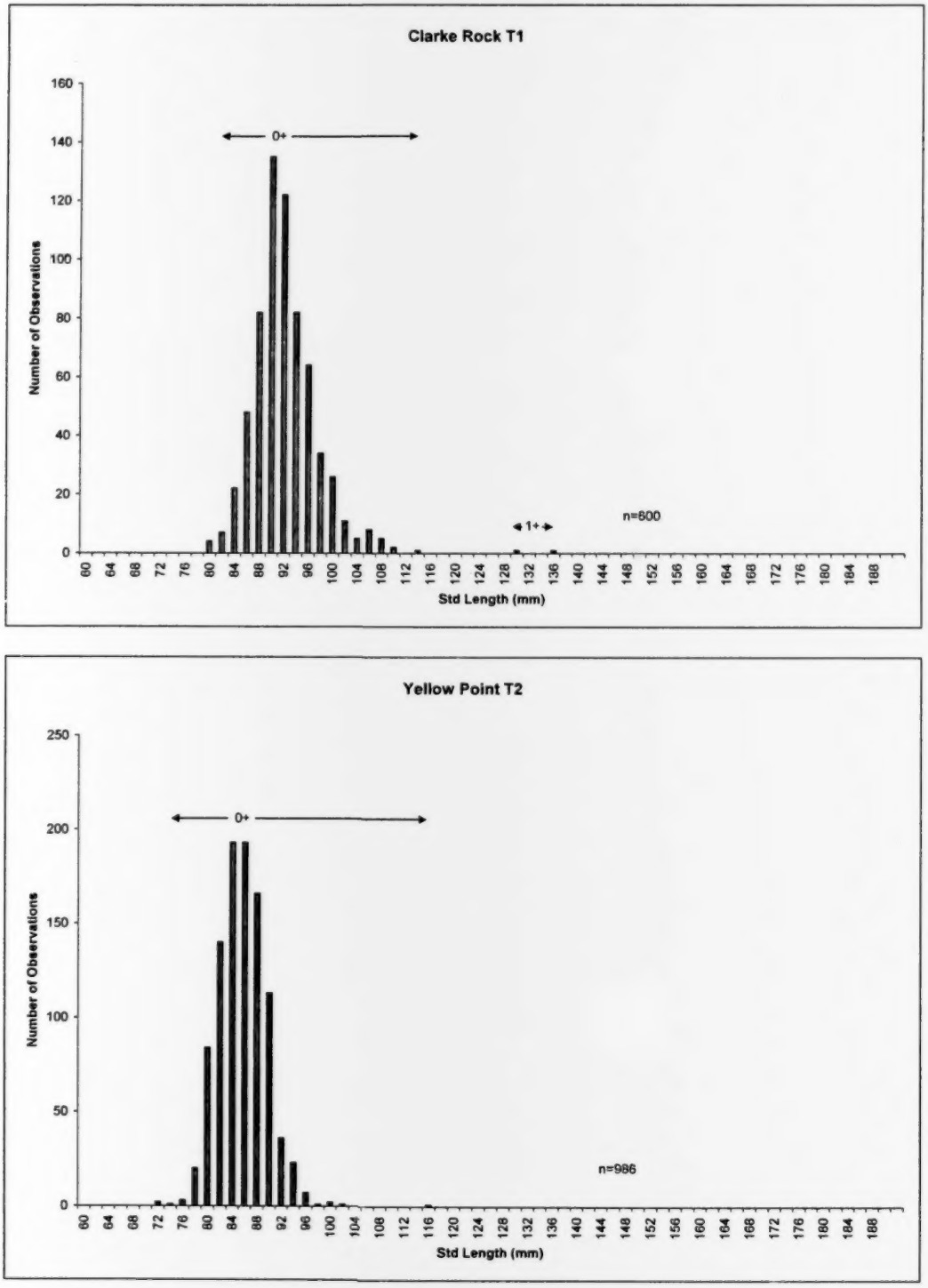
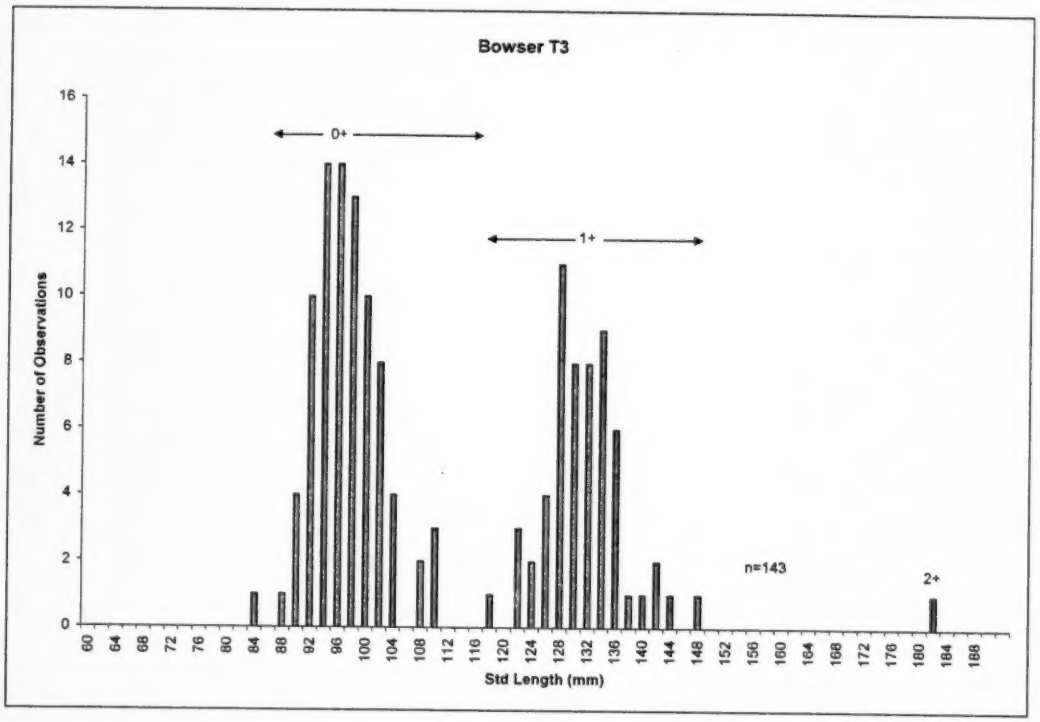


Figure 5. Length-frequency histograms by transect for 2004.



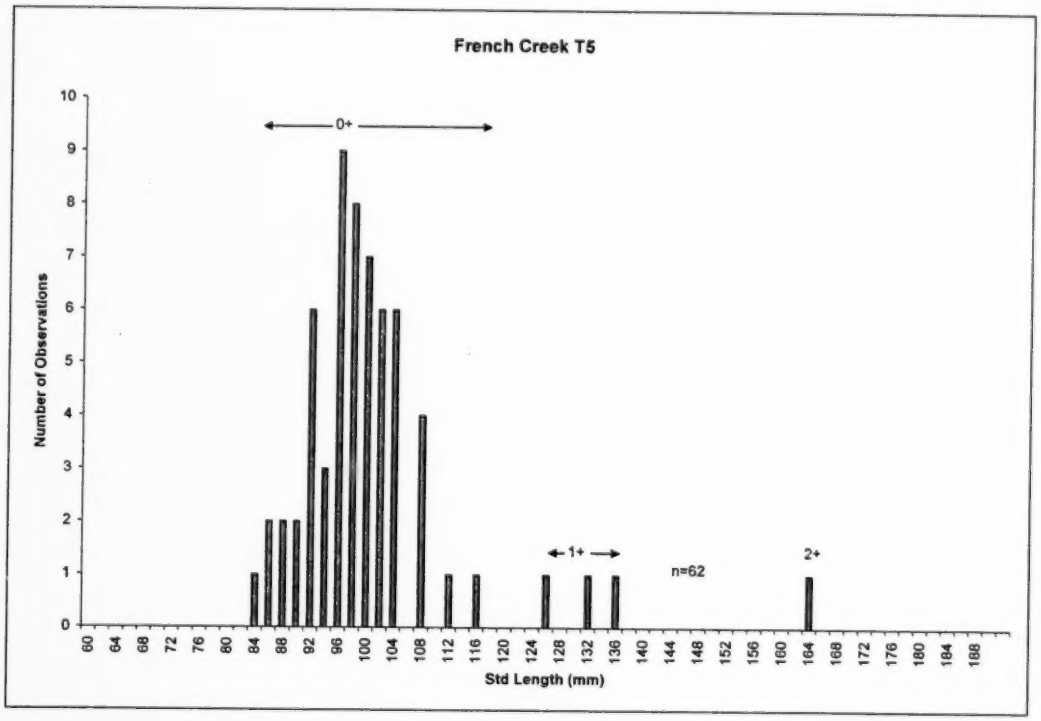
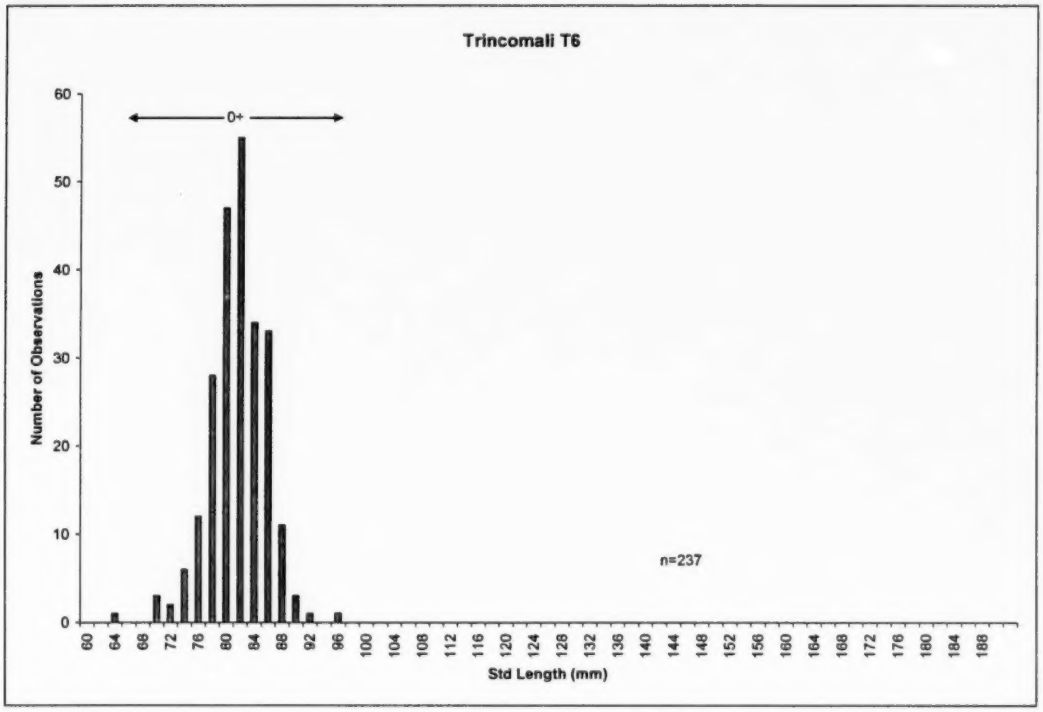


Figure 5 continued…



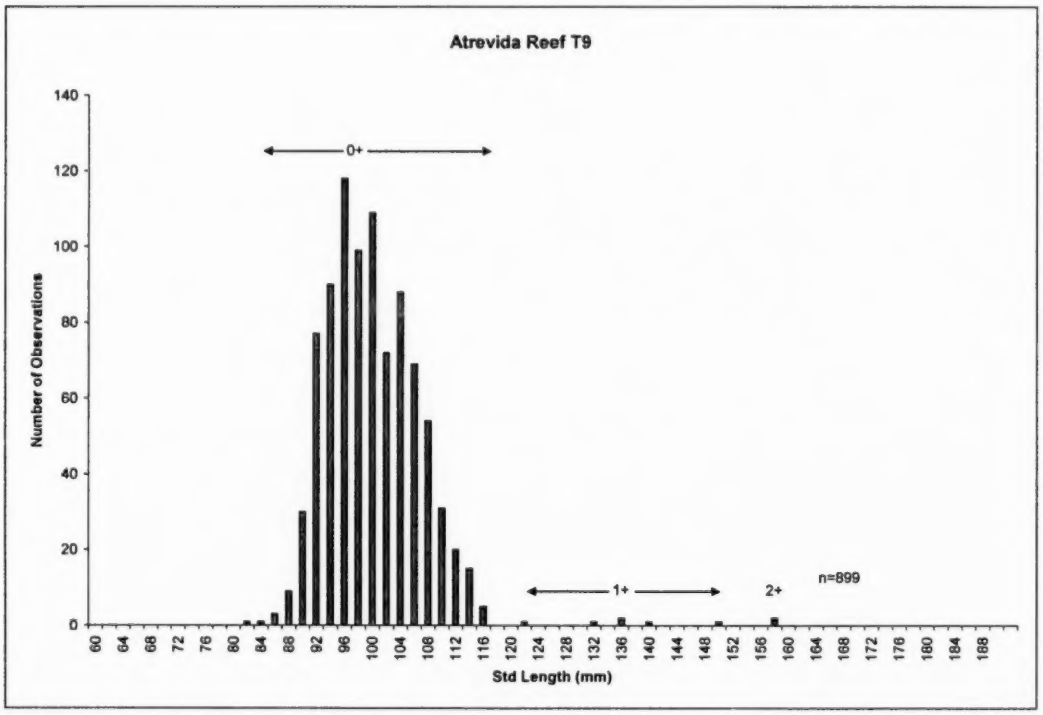
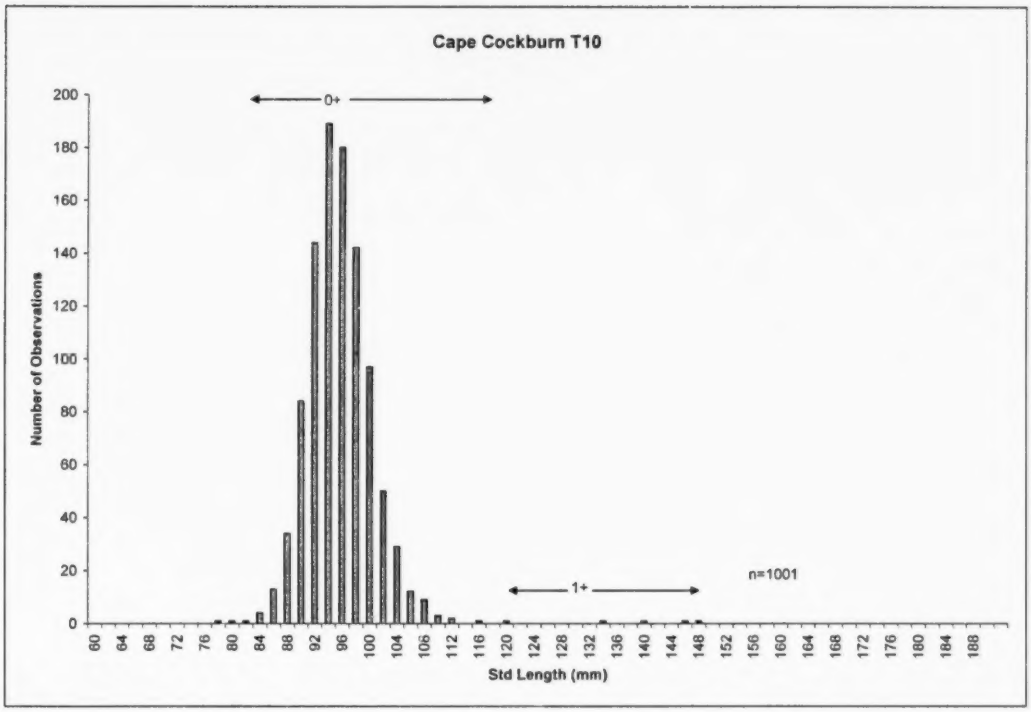


Figure 5 continued…



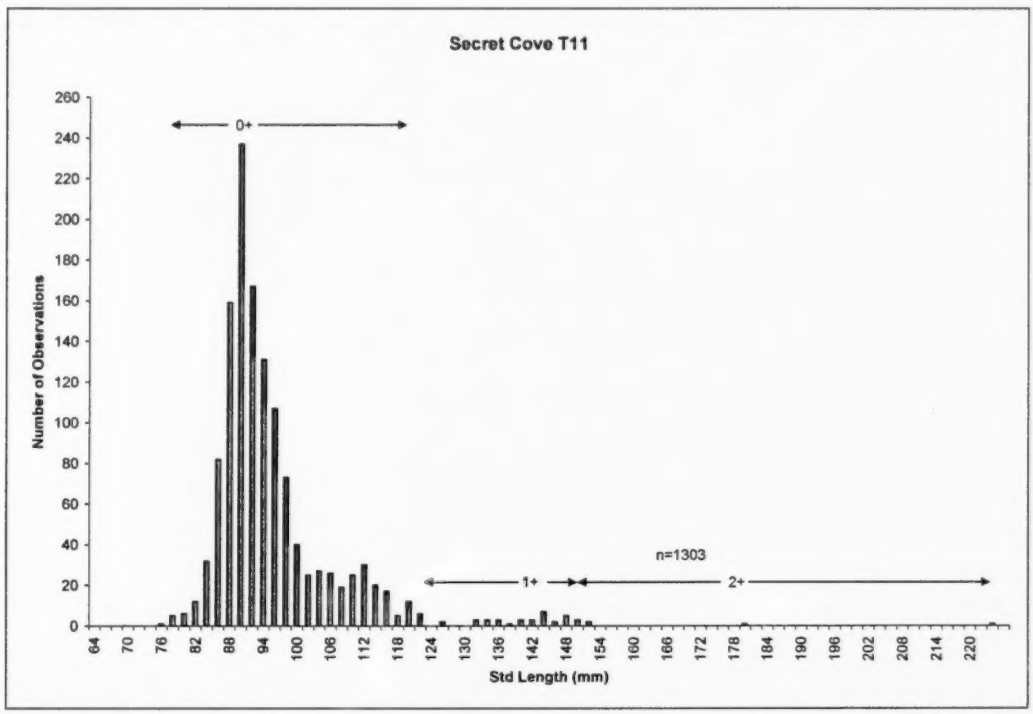


Figure 5 continued…

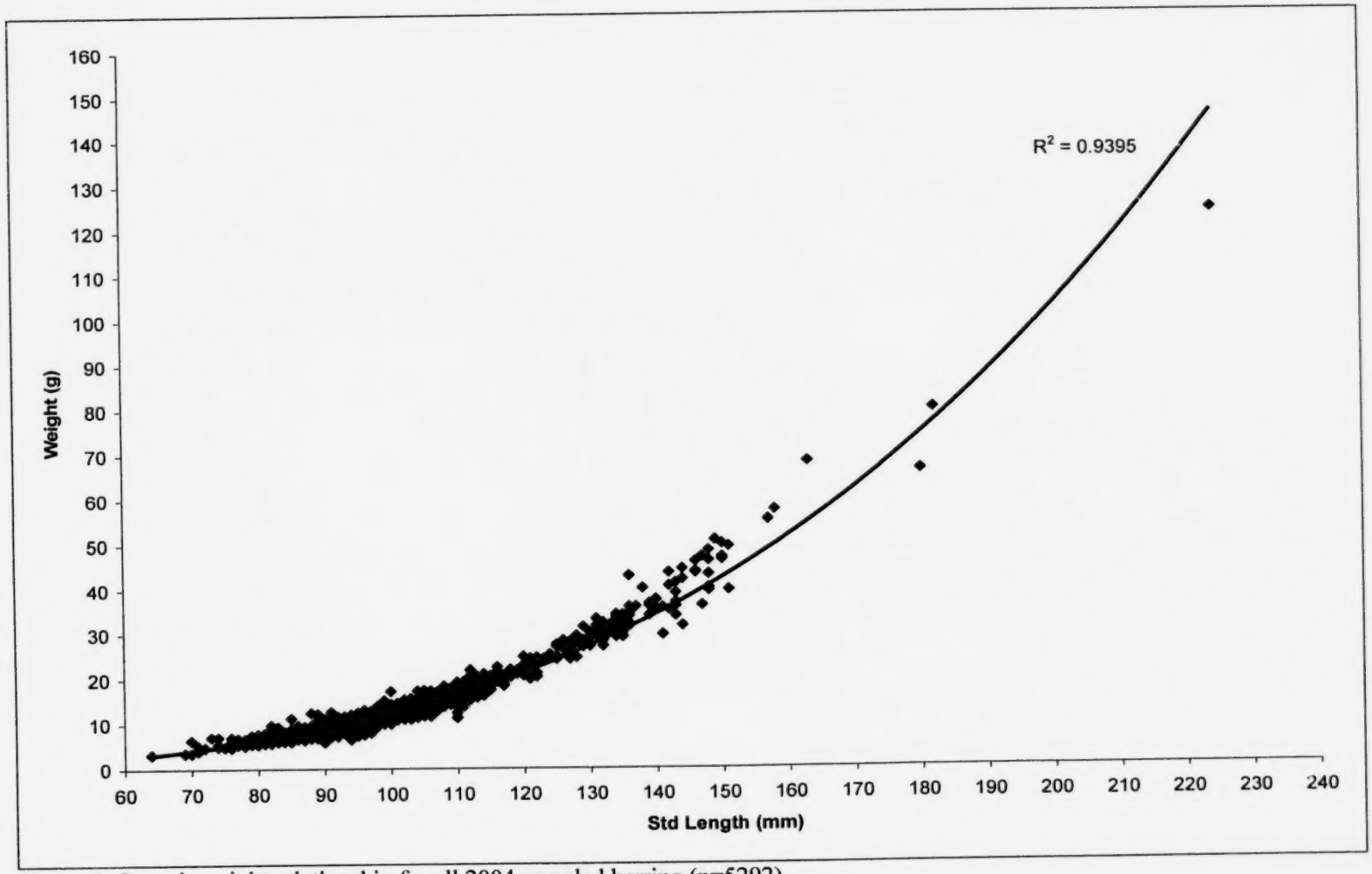


Figure 6. Length-weight relationship for all 2004 sampled herring (n=5292).

Table 1. Summary of all 2004 Strait of Georgia purse seine sets.

Year	Month	Day	Transect	Station	Seine Set Time	Location Name	DD Lat (N)	DD Long (W)
2004	9	23	1	1	2005	Clarke Rock	49.2236	123.9433
2004	9	23	1	2	2100	Clarke Rock	49.2333	123.9317
2004	9	23	1	3	2150	Clarke Rock	49.2367	123.9217
2004	9	23	1	4	2230	Clarke Rock	49.2370	123.9120
2004	9	23	1	5	2300	Clarke Rock	49.2380	123.9020
2004	9	20	2	1	2320	Yellow Point	49.0424	123.7470
2004	9	20	2	2	2240	Yellow Point	49.0480	123.7220
2004	9	20	2	3	2200	Yellow Point	49.0558	123.7223
2004	9	20	2	4	2115	Yellow Point	49.0600	123.7080
2004	9	20	2	5	2040	Yellow Point	49.0658	123.6983
2004	9	28	3	1	2300	Bowser	49.4517	124.6800
2004	9	28	3	2	2220	Bowser	49.4592	124.6725
2004	9	28	3	3	2150	Bowser	49.4667	124.6633
2004	9	28	3	4	2120	Bowser	49.4760	124.6570
2004	9	28	3	5	2035	Bowser	49.4820	124.6510
2004	9	29	4	1	2020	Henry Bay	49.5933	124.8750
2004	9	29	4	3	2050	Henry Bay	49.5983	124.8556
2004	9	27	5	1	2240	French Creek	49.3483	124.3500
2004	9	27	5	2	2205	French Creek	49.3533	124.3383
2004	9	27	5	3	2130	French Creek	49.3575	124.3267
2004	9	27	5	4	2055	French Creek	49.3615	124.3230
2004	9	27	5	5	2020	French Creek	49.3658	124.3170
2004	9	21	6	1	2000	Trincomali	48.8549	123.4303
2004	9	21	6	2	2045	Trincomali	48.8620	123.4230
2004	9	21	6	3	2125	Trincomali	48.8667	123.4167
2004	9	21	6	4	2155	Trincomali	48.8730	123.4070
2004	9	21	6	5	2225	Trincomali	48.8767	123.4067
2004	9	30	8	1	2100	Smelt Bay	50.0358	125.0000
2004	9	30	8	2	2020	Smelt Bay	50.0456	125.0159
2004	9	30	8	3	1945	Smelt Bay	50.0541	125.0300
2004	10	1	9	1	2225	Atrevida Reef	49.9164	124.6594
2004	10	1	9	2	2140	Atrevida Reef	49.9120	124.6734
2004	10	1	9	3	2110	Atrevida Reef	49.9090	124.6838
2004	10	1	9	4	2040	Atrevida Reef	49.9058	124.6943
2004	10	1	9	5	2005	Atrevida Reef	49.9021	124.7065
2004	10	2	10	1	2250	Cape Cockburn	49.6695	124.1981
2004	10	2	10	2	2220	Cape Cockburn	49.6620	124.2180
2004	10	2	10	3	2145	Cape Cockburn	49.6508	124.2417
2004	10	2	10	4	2110	Cape Cockburn	49.6420	124.2550
2004	10	2	10	5	2025	Cape Cockburn	49.6318	124.2781
2004	10	3	11	1	1940	Secret Cove	49.5350	123.9767
2004	10	3	11	2	2015	Secret Cove	49.5317	123.9950
2004	10	3	11	3	2050	Secret Cove	49.5283	124.0142
2004	10	3	11	4	2130	Secret Cove	49.5270	124.0400
2004	10	3	11	5	2200	Secret Cove	49.5230	124.0600

Table 2. Species number and weight by transect and station for 2004 (trace = ≤ 9g).

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
1	1	Clarke Rock	**Pacific Herring - Age 0+**	25	0.19
			Pipefish	100	
			Shiner Perch	35	
			Flatfish	34	
			Sculpin	21	
			Midshipman	15	
			Kelp perch	9	
			Lingcod Juvenile	4	
			Pollock Juvenile	4	
			Greenling	3	
			Pile perch	3	
			Chinook Salmon	1	0.06
			Pacific Cod	1	
			Pacific Tomcod	1	
			Rockfish Juvenile	1	
			Jellyfish		
			Squid		
1	2	Clarke Rock	**Pacific Herring - Age 0+**	33	0.28
1	3	Clarke Rock	**Pacific Herring - Age 0+**	281	2.55
			Pacific Herring - Age 1+	2	0.06
			Hake Juvenile	5	
			Chum Salmon	2	0.14
			Chinook Salmon	1	0.06
			Smelt Juvenile	1	
			Stickleback	1	
1	4	Clarke Rock	**Pacific Herring - Age 0+**	319	2.85
			Pacific Herring - Age 1+	2	0.05
			Hake Juvenile	3	
			Chum Salmon	2	0.14
			Pink Salmon	1	0.08
			Squid	1	
1	5	Clarke Rock	**Pacific Herring - Age 0+**	2537	22.00
			Chum Salmon	12	0.99
			Chinook Salmon	1	0.06
			Hake Juvenile	1	
			Squid	1	

Table 2 continued...

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
2	1	Yellow Point	**Pacific Herring - Age 0+**	185	1.36
			Northern Anchovy	1	0.01
			Jellyfish		0.07
			Squid		
2	2	Yellow Point	**Pacific Herring - Age 0+**	38005	312.40
			Jellyfish		289.60
2	3	Yellow Point	**Pacific Herring - Age 0+**	13075	102.90
			Jellyfish		217.20
2	4	Yellow Point	**Pacific Herring - Age 0+**	14993	112.00
			Jellyfish		217.20
2	5	Yellow Point	**Pacific Herring - Age 0+**	21330	157.20
			Jellyfish		434.40
3	1	Bowser	Shiner Perch	13	0.07
			Squid	12	0.10
			Midshipman	8	trace
			Stickleback	8	trace
			Chum Salmon	2	0.16
			Pollock Juvenile	1	0.01
			Sculpin	1	0.02
			Chinook Salmon	1	0.05
			Jellyfish		30.00
3	2	Bowser	**Pacific Herring - Age 1+**	1	0.03
			Chinook Salmon	16	0.93
			Chum Salmon	15	1.34
			Stickleback	3	trace
			Pipefish	1	trace
			Pink Salmon	1	0.07
			Coho Salmon	1	0.09
			Jellyfish		72.40
			Squid	50	1.20

Table 2 continued…

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
3	3	Bowser	**Pacific Herring - Age 0+**	4	0.04
			Chinook Salmon	4	0.19
			Gunnel	1	0.01
			Northern Anchovy	1	0.02
			Chum Salmon	1	0.12
			Squid		2.20
			Jellyfish		6.70
3	4	Bowser	**Pacific Herring - Age 0+**	4	0.04
			Pink Salmon	2	0.16
			Hake Juvenile	1	trace
			Chinook Salmon	1	0.06
			Chum Salmon	1	0.11
			Squid		1.40
3	5	Bowser	**Pacific Herring - Age 0+**	77	0.86
			Pacific Herring - Age 1+	56	1.70
			Pacific Herring - Age 2+	1	0.08
			Chum Salmon	7	0.68
			Pink Salmon	4	0.32
			Chinook Salmon	3	0.25
			Pipefish	1	trace
			Lingcod Juvenile	1	0.01
			Pollock Juvenile		2.20
			Squid		1.00
5	1	French Creek	**Pacific Herring - Age 0+**	4	0.03
			Midshipman	11	0.05
			Surf perch	10	0.20
			Chinook Salmon	8	0.49
			Squid	5	0.12
			Pollock Juvenile	2	0.04
			Sculpin	2	0.20
			Flatfish	2	0.30
			Pink Salmon	1	0.08
5	2	French Creek	**Pacific Herring - Age 0+**	3	0.04
			Pacific Herring - Age 1+	3	0.08
			Pacific Herring - Age 2+	1	0.07
			Pink Salmon	3	0.26
			Chinook Salmon	2	0.10
			Coho Salmon	1	0.08

Table 2 continued...

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
5	3	French Creek	Chum Salmon	10	0.90
			Pink Salmon	2	0.15
			Chinook Salmon	1	0.21
5	4	French Creek	**Pacific Herring - Age 0+**	20	0.21
			Chum Salmon	17	1.73
			Squid	8	0.08
			Pink Salmon	2	0.15
5	5	French Creek	**Pacific Herring - Age 0+**	31	0.36
			Chum Salmon	15	1.40
			Pink Salmon	6	0.49
			Euphausiid		5.00
6	1	Trincomali Channel	**Pacific Herring - Age 0+**	78	0.53
			Jellyfish		36.20
6	2	Trincomali Channel	**Pacific Herring - Age 0+**	49	0.31
			Pollock Juvenile	2	
			Chum Salmon	1	0.08
			Hake Juvenile	1	
6	3	Trincomali Channel	**Pacific Herring - Age 0+**	25	0.16
			Pollock Juvenile	6	
			Jellyfish	4	
			Chum Salmon	2	0.13
			Stickleback	2	
			Smelt Juvenile	1	
			Squid		
6	4	Trincomali Channel	**Pacific Herring - Age 0+**	44	0.28
			Chum Salmon	1	0.04
			Jellyfish	1	
			Midshipman	1	
			Squid		
6	5	Trincomali Channel	**Pacific Herring - Age 0+**	41	0.24
			Smelt Juvenile	2	
			Chum Salmon	1	0.08
			Squid		

Table 2 continued...

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
8	1	Smelt Bay	Chinook Salmon	1	0.03
			Coho Salmon	1	0.05
			Chum Salmon	1	0.07
			Sandlance	1	
			Squid	14	0.14
8	2	Smelt Bay	**Pacific Herring - Age 0+**	1	0.01
			Chum Salmon	10	1.05
			Chinook Salmon	3	0.22
			Squid	2	0.03
8	3	Smelt Bay	Chinook Salmon	1	0.06
			Squid		1.00
			Jellyfish		10.00
9	1	Atrevida Reef	Chinook Salmon	1	0.03
			Squid	40	0.12
9	2	Atrevida Reef	**Pacific Herring - Age 0+**	197	2.37
			Pacific Herring - Age 1+	5	0.18
			Northern Anchovy	6	
			Dogfish		1.30
			Smelt Juvenile	3	
			Squid	8	0.02
9	3	Atrevida Reef	**Pacific Herring - Age 0+**	4136	55.50
			Hake Juvenile	16	0.10
			Squid	6	0.05
			Shrimp	3	0.01
			Smelt Juvenile	1	trace
9	4	Atrevida Reef	**Pacific Herring - Age 0+**	2946	35.00
			Hake Juvenile	16	0.09
			Smelt Juvenile	1	trace
			Northern Anchovy	1	0.01
			Chinook Salmon	1	0.07
			Squid	8	0.03

Table 2 continued...

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
9	5	Atrevida Reef	**Pacific Herring - Age 0+**	3052	36.32
			Pacific Herring - Age 1+	15	0.56
			Pacific Herring - Age 2+	31	1.75
			Shrimp	18	0.07
			Hake Juvenile	5	0.04
			Chinook Salmon	1	0.05
			Squid	5	0.05
10	1	Cape Cockburn	**Pacific Herring - Age 0+**	2622	25.35
			Pacific Herring - Age 1+	13	0.43
10	2	Cape Cockburn	**Pacific Herring - Age 0+**	934	10.50
			Ctenophores		10.00
10	3	Cape Cockburn	**Pacific Herring - Age 0+**	2389	25.20
10	4	Cape Cockburn	**Pacific Herring - Age 0+**	2072	22.30
			Chinook Salmon	1	0.04
			Chum Salmon	1	0.13
			Euphausiid		13.30
10	5	Cape Cockburn	**Pacific Herring - Age 0+**	1638	19.25
			Pacific Herring - Age 1+	25	1.05
			Pollock Juvenile	9	0.09
			Squid	59	0.50
11	1	Secret Cove	**Pacific Herring - Age 0+**	1122	10.11
			Pacific Herring - Age 1+	5	0.12
			Pacific Herring - Age 2+	5	0.62
			Smelt Juvenile	10	
			Shiner Perch	5	0.03
			Sockeye Salmon	3	0.09
			Hake Juvenile	2	0.01
			Chinook Salmon	2	0.07
			Squid	22	0.20

Table 2 continued...

Transect	Station	Location Name	Species Name	Number	Weight (Kg)
11	2	Secret Cove	**Pacific Herring - Age 0+**	1312	11.70
			Pacific Herring - Age 1+	13	0.51
			Hake Juvenile	125	11.50
			Stickleback	1	trace
			Chinook Salmon	1	0.08
			Hake Adult	1	0.25
			Squid	22	0.15
11	3	Secret Cove	**Pacific Herring - Age 0+**	698	7.90
			Pacific Herring - Age 1+	63	2.10
			Hake Juvenile	20	0.10
			Pollock Juvenile	9	0.09
			Hake Adult	4	1.00
			Chinook Salmon	1	0.04
			Northern Anchovy	1	
			Squid	6	0.04
11	4	Secret Cove	**Pacific Herring - Age 0+**	254	2.61
			Pacific Herring - Age 1+	7	0.24
			Chum Salmon	3	0.31
			Chinook Salmon	2	0.07
11	5	Secret Cove	**Pacific Herring - Age 0+**	502	4.62
			Pacific Herring - Age 2+	3	0.20
			Smelt Juvenile	1	
			Hake Adult		2.00

Table 3. Percent species occurrence in purse seine sets for 2004.

Common name	Scientific Name	% Occurrence
Pacific herring Age-0+	*Clupea pallasi* in year of birth	82.2
Pacific herring Age-1+	*Clupea pallasi* in first year	28.9
Pacific herring Age-2+	*Clupea pallasi* in second or more years	11.1
Chinook Salmon	*Oncorhynchus tshawytscha*	48.9
Chum Salmon	*Oncorhynchus keta*	42.2
Coho Salmon	*Oncorhynchus kisutch*	6.7
Ctenophores		2.2
Euphausiid		4.4
Flatfish	*Parophyrus vetulus, Lepidopsetta bilineata, Platichthys stellatus, Citharichthys stigmaens*	4.4
Greenling	*Hexagrammos sp.*	2.2
Gunnel	*Apodichthys flavidus, Pholis laeta*	2.2
Hake Adult	*Merluccius productus*	6.7
Hake Juvenile	*Merluccius productus*	24.4
Jellyfish*		28.9
Kelp perch	*Brachyistius frenatus*	2.2
Lingcod Juvenile	*Ophiodon elongatus*	4.4
Midshipman	*Porichthys notatus*	8.9
Northern Anchovy	*Engraulis mordax mordax*	11.1
Pacific Cod	*Gadus macrocephalus*	2.2
Pacific Tomcod	*Microgadus proximus*	2.2
Pile perch	*Rhacochilus vacca*	2.2
Pink Salmon	*Oncorhynchus gorbuscha*	20.0
Pipefish	*Syngnathus griseolineatus*	6.7
Rockfish Juvenile	*Sebastes sp.*	2.2
Sandlance	*Ammodytes hexapterus*	2.2
Sculpin	*Leptocottus armatus*	6.7
Shiner Perch	*Cymatogaster aggregata*	6.7
Shrimp		4.4
Smelt Juvenile	*Mallotus villosus, Hypomesus pretiosus, or Allosmerus elongatus*	17.8
Sockeye Salmon	*Oncorhynchus nerka*	2.2
Spiny dogfish	*Squalus acanthias*	2.2
Squid*	*Loligo opalescens, Gonatus fabricii*	57.8
Stickleback	*Gasterosteus aculeatus*	11.1
Surf perch	*Hyperprosopon sp. or Amphistichus sp.*	2.2
Walleye Pollock Juvenile	*Theragra chalcogramma*	17.8

* Squid and jellyfish occurrence may not be representative due to the large quantities usually encountered and the inability to correctly quantify.

Table 4. Number sampled, size range, mean length, mean weight, weight range and standard deviations for all three observed age classes. Total catch in numbers and total catch weight of all herring by transect for 2004.

Age-0+			Length (mm)				Weight (g)					
Location	Transect	Sample (n)	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev	Catch (n)	Total Catch Weight (Kg)
Clarke Rock	1	658	79	114	92	4.95	5.7	18.9	8.8	1.55	3195	27.86
Yellow Point	2	986	71	115	85	3.92	4.2	18.5	7.7	1.05	87588	685.86
Bowser	3	85	83	118	97	5.49	6.7	21.9	11.0	2.17	85	0.93
Henry Bay	4	-	-	-	-	-	-	-	-	-	0	-
French Creek	5	58	84	116	98	6.44	7.1	19.9	11.0	2.53	58	0.64
Trincomali Channel	6	237	64	95	81	3.99	3.2	11.8	6.4	0.88	237	1.52
Smelt Bay	8	1	93	93	93	-	11	11	11.0	-	1	0.01
Atrevida Reef	9	891	82	116	99	6.15	6.3	22.5	12.3	2.63	10331	129.19
Cape Cockburn	10	997	77	119	95	4.58	5.8	21.7	10.8	1.83	9655	102.61
Secret Cove	11	1258	76	120	94	8.03	5.2	24.8	10.0	3.17	3888	36.94
All Locations		5171			93				9.8		115038	985.56

Age-1+			Length (mm)				Weight (g)					
Location	Transect	Sample (n)	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev	Catch (n)	Total Catch Weight (Kg)
Clarke Rock	1	2	130	136	133	4.24	27.1	32.1	29.6	3.54	4	0.12
Yellow Point	2	-	-	-	-	-	-	-	-	-	0	-
Bowser	3	57	122	147	131	5.33	23.6	43.5	30.3	4.44	57	1.72
Henry Bay	4	-	-	-	-	-	-	-	-	-	0	-
French Creek	5	3	125	135	131	5.13	27	29.2	27.8	1.24	3	0.08
Trincomali Channel	6	-	-	-	-	-	-	-	-	-	0	-
Smelt Bay	8	-	-	-	-	-	-	-	-	-	0	-
Atrevida Reef	9	6	121	150	136	9.61	24.4	46.9	36.8	7.82	20	0.74
Cape Cockburn	10	4	134	148	142	6.45	33	46.17	39.7	6.22	38	1.48
Secret Cove	11	43	121	151	138	9.49	19.9	50.7	35.1	8.66	88	2.97
All Locations		115			134				32.6		210	7.12

Table 4 continued…

Age-2+			Length (mm)				Weight (g)					
Location	Transect	Sample (n)	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev	Catch (n)	Total Catch Weight (Kg)
Clarke Rock	1	-	-	-	-	-	-	-	-	-	0	-
Yellow Point	2	-	-	-	-	-	-	-	-	-	0	-
Bowser	3	1	182	182	182	-	79.8	79.8	79.8	-	1	0.08
Henry Bay	4	-	-	-	-	-	-	-	-	-	0	-
French Creek	5	1	163	163	163	-	68.1	68.1	68.1	-	1	0.07
Trincomali Channel	6	-	-	-	-	-	-	-	-	-	0	-
Smelt Bay	8	-	-	-	-	-	-	-	-	-	0	-
Atrevida Reef	9	2	157	158	158	0.71	55.2	57.4	56.3	1.56	31	1.75
Cape Cockburn	10	-	-	-	-	-	-	-	-	-	0	-
Secret Cove	11	2	180	224	202	31.11	66.2	123.9	95.1	40.80	8	0.82
All Locations		6			177				75.1		41	2.71

Table 5. Categories of organisms, by phylum, identified in plankton tows.

Coelenterata	
COEL	Medusae
SIPH	Siphonophores
Ctenophora	
CTEN	Ctenophores
Annelida	
POLY	Polychaetes – segmented worms
Mollusca	
GAST	Prosobranch gastropods
PELE	Pelecypods
Arthropoda	
AMPH	Amphipods
BARN	Barnacle, unknown stage
CLAD	Cladocerans; *Podon sp.* and *Evadne sp.*
COPE	Copepods (See Table 6 for a list of species)
CRAM	Crab megalopea, including porcillinadea
CRAZ	Crab zoea, including porcillinadea
EUPA	Euphausiid adults
EUPL	Euphausiid larvae (nauplii, protozoea and zoea)
MYSI	Mysids
SHRI	Shrimp (natant decapod) zoea
Ectoprocta	
ECTO	Ectoprocts, mostly *Membranipora sp.* larvae (cyphonautes)
Echinodermata	
ECHI	Echinoderm larvae
Chaetognatha	
CHAE	Chaetognaths, mostly *Sagitta sp.*
Chordata	
LARV	Larvaceans, mostly *Oikopleura sp.*, and tunicate larvae
OTHJ	Teleost larvae
Miscellaneous	
EGGS	Unidentified eggs, euphausiid or teleost

Table 6. Calanoid, cyclopoid and harpacticoid copepods identified in 2004 plankton samples. Abbreviations are used to identify organisms in Table 7.

Calanoid copepods

ALON	*Acartia longiremis*
CABD	*Centropages abdominales*
CCOL	*Canadacia columbiae*
CMAR	*Calanus marshallae*
CNAU	Unidentified copepod nauplii
CPAC	*Calanus pacificus*
EBUN	*Eucalanus bungii*
ELON	*Epilabidocera longipedata*
MPSE	*Metridia pseudopacifica*
OBOR	*Oncaea borealis*
PMIN	*Pseudocalanus minitus*
PPAR	*Paracalanus parvus*
TDIS	*Tortanus discaudatus*
UCAL	Unidentified calanoids, unknown species

Cyclopoid copepods

CANG	*Corycaeus anglicus*
OATL	*Oithona atlantica*
OITH	*Oithona* sp.
OSIM	*Oithona similis*

Harpacticoid copepods

UHAR	Unidentified harpacticoids, unknown species

Table 7. Zooplankton density per set in number of organisms per m^3 of water sampled for 2004.

Location	Tran	Stn	Volume	ALON	AMPH	BARN	CABD	CANG	CCOL	CHAE	CLAD	CMAR	CNAU	COEL
Clarke Rock	1	1	14.0595	-	-	8.0	-	60.3	-	-	130.9	-	-	1.6
Clarke Rock	1	3	14.9287	-	1.2	20.4	-	40.7	-	0.1	57.9	-	-	-
Clarke Rock	1	5	19.2583	-	0.9	19.9	-	32.4	-	0.1	52.3	-	-	0.1
Yellow Point	2	1	9.5246	-	-	292.5	-	121.0	-	-	483.8	-	16.8	2.7
Yellow Point	2	3	16.9296	-	0.9	75.7	-	58.6	-	-	76.6	-	2.8	0.9
Yellow Point	2	5	16.2771	-	0.1	102.2	-	49.1	-	-	175.0	-	5.9	0.9
Bowser	3	1	7.2469	-	1.0	6888.6	-	141.3	-	-	1024.4	-	-	0.7
Bowser	3	3	6.9487	-	18.7	1842.1	-	128.9	-	-	92.1	-	-	0.3
Bowser	3	5	7.5769	-	-	1410.6	-	67.6	-	1.1	152.0	-	-	9.0
Henry Bay	4	1	7.2674	-	1.8	572.4	-	28.6	-	-	55.0	-	-	16.4
Henry Bay	4	3	12.4214	-	1.6	486.9	-	64.4	-	-	30.9	-	-	18.8
Henry Bay	4	5	10.3764	0.2	1.5	542.8	-	0.8	-	-	169.6	-	-	15.9
French Creek	5	1	11.1445	-	-	925.3	-	23.0	-	-	74.7	-	-	0.4
French Creek	5	3	16.8201	-	-	40.9	-	32.3	-	0.4	-	0.1	-	0.1
French Creek	5	5	17.1570	-	9.1	3.7	-	46.6	0.5	9.1	-	0.9	-	0.2
Trincomali	6	1	15.4337	2.1	6.9	56.0	-	103.7	-	-	20.7	-	-	9.1
Trincomali	6	3	18.2392	2.6	5.3	50.9	0.9	72.8	-	-	26.3	-	-	1.0
Trincomali	6	5	17.2536	0.9	8.8	68.6	-	42.7	-	41.7	-	-	-	1.0
Smelt Bay	8	1	14.8618	2.2	4.4	17.2	-	73.2	-	-	-	-	-	1.1
Smelt Bay	8	2	15.8604	-	6.6	-	-	262.3	-	-	-	-	-	4.0
Atrevida Reef	9	1	13.8169	-	4.6	4.6	-	32.4	-	-	-	-	4.6	0.7
Atrevida Reef	9	3	11.8768	-	8.8	8.1	-	32.3	-	-	-	-	-	-
Atrevida Reef	9	5	11.5780	-	10.0	-	-	22.1	-	-	-	-	-	-
Cape Cockburn	10	1	16.6597	-	0.2	8.6	-	37.5	-	0.1	-	-	-	0.3
Cape Cockburn	10	3	12.2791	-	-	-	-	46.9	-	-	-	-	-	-
Cape Cockburn	10	5	13.3857	-	7.2	-	-	124.3	-	0.1	-	-	-	9.6
Secret Cove	11	1	14.2899	9.0	20.3	33.7	-	114.2	-	-	2.2	-	-	0.3
Secret Cove	11	3	10.6874	3.0	12.8	3.0	-	164.7	-	-	-	-	-	0.2
Secret Cove	11	5	15.6003	2.1	24.7	6.2	-	248.2	-	-	-	-	-	0.1

Table 7 continued…

Location	Tran	Stn	CPAC	CRAM	CRAZ	CTEN	EBUN	ECHI	ECTO	EGGS	ELON	EUPA	EUPL	GAST
Clarke Rock	1	1	-	0.1	2.3	0.1	-	-	-	8.0	-	-	-	17.1
Clarke Rock	1	3	-	0.1	0.5	-	-	-	30.0	-	-	-	-	-
Clarke Rock	1	5	8.3	0.1	0.1	-	-	-	-	20.8	-	-	-	0.8
Yellow Point	2	1	-	-	0.5	-	-	-	-	43.7	-	-	-	23.5
Yellow Point	2	3	-	0.1	1.2	-	-	0.9	-	0.9	-	-	-	2.8
Yellow Point	2	5	3.9	0.3	1.1	-	-	-	-	-	-	-	0.1	7.9
Bowser	3	1	4.7	0.4	0.8	-	-	-	-	35.3	-	-	-	106.0
Bowser	3	3	19.6	0.6	0.6	0.9	-	-	-	18.4	-	-	0.6	92.1
Bowser	3	5	1326.1	-	1.6	0.5	-	-	-	25.3	-	8.4	3.2	33.8
Henry Bay	4	1	-	-	0.1	-	-	-	11.0	-	-	-	-	6.6
Henry Bay	4	3	1.9	0.2	6.0	0.1	-	-	15.5	-	-	-	-	15.5
Henry Bay	4	5	-	0.3	30.6	-	-	-	3.1	-	-	-	-	15.4
French Creek	5	1	-	-	-	-	-	-	11.5	-	-	-	-	23.0
French Creek	5	3	0.5	-	1.0	-	-	-	1.9	-	-	-	-	1.0
French Creek	5	5	40.3	-	-	-	-	-	-	-	-	7.7	0.5	7.7
Trincomali	6	1	0.1	0.5	0.3	2.8	-	-	-	2.1	-	-	-	8.3
Trincomali	6	3	-	0.1	0.5	0.2	-	-	-	-	-	-	-	0.9
Trincomali	6	5	-	0.2	1.6	0.5	-	-	-	-	-	-	-	11.1
Smelt Bay	8	1	-	-	4.6	0.1	-	-	2.2	-	0.1	-	-	66.7
Smelt Bay	8	2	102.9	0.3	3.5	-	-	-	-	2.0	-	-	-	22.2
Atrevida Reef	9	1	-	-	-	-	-	-	78.7	-	-	0.1	-	13.9
Atrevida Reef	9	3	0.1	-	-	-	0.1	-	2.7	-	-	-	-	-
Atrevida Reef	9	5	4.1	-	-	-	-	-	2.8	-	-	33.5	1.0	-
Cape Cockburn	10	1	0.1	-	-	2.3	-	-	-	-	-	-	-	-
Cape Cockburn	10	3	-	-	-	-	-	-	-	-	-	-	98.4	-
Cape Cockburn	10	5	-	0.1	-	0.1	0.1	-	-	-	-	-	-	28.7
Secret Cove	11	1	-	-	0.1	0.3	-	-	-	2.2	-	0.1	-	15.7
Secret Cove	11	3	0.3	-	-	0.1	-	-	-	3.0	-	-	-	-
Secret Cove	11	5	0.2	0.1	0.2	0.2	-	-	-	2.1	-	0.3	0.1	-

Table 7 continued…

Location	Tran	Stn	LARV	MPSE	MYSI	OATL	OBOR	OITH	OSIM	OSTR	OTHJ	PELE	PMIN	POLY
Clarke Rock	1	1	36.4	-	-	5.7	-	-	2.3	-	-	-	-	-
Clarke Rock	1	3	2.1	-	-	1.1	-	2.1	-	1.1	-	-	1.1	1.1
Clarke Rock	1	5	30.7	-	-	0.8	-	0.8	0.8	-	-	-	6.6	-
Yellow Point	2	1	248.6	-	-	-	-	-	10.1	-	-	6.7	-	40.3
Yellow Point	2	3	36.9	-	-	-	-	-	8.5	-	-	-	-	5.7
Yellow Point	2	5	29.5	-	0.1	-	-	-	11.8	-	-	5.9	-	17.8
Bowser	3	1	989.3	0.1	-	-	-	-	-	-	-	-	35.3	-
Bowser	3	3	1584.2	-	-	-	-	18.4	73.7	-	-	-	18.4	37.1
Bowser	3	5	447.7	-	1.1	-	-	16.9	-	-	-	-	-	-
Henry Bay	4	1	15.4	-	-	-	-	-	28.6	-	-	-	-	15.4
Henry Bay	4	3	128.8	-	-	-	-	-	18.0	-	-	-	-	41.3
Henry Bay	4	5	21.6	-	-	-	-	-	-	-	-	-	-	3.2
French Creek	5	1	511.1	-	-	-	-	-	45.9	-	0.1	-	-	-
French Creek	5	3	65.6	0.1	-	17.1	-	2.9	-	-	-	-	-	-
French Creek	5	5	16.8	25.9	-	3.7	-	5.6	-	13.1	-	-	-	0.5
Trincomali	6	1	82.9	-	-	-	-	-	-	-	-	-	4.1	24.9
Trincomali	6	3	57.9	-	-	-	-	-	-	-	-	-	3.5	6.1
Trincomali	6	5	24.1	-	-	-	-	-	-	-	0.1	0.9	-	8.3
Smelt Bay	8	1	230.4	-	-	-	-	-	-	-	0.1	-	-	10.8
Smelt Bay	8	2	195.7	-	-	4.0	-	12.1	-	-	-	2.0	-	23.5
Atrevida Reef	9	1	384.5	-	-	199.2	-	291.8	46.3	-	-	-	-	-
Atrevida Reef	9	3	471.5	-	-	212.9	-	137.4	21.6	-	-	-	2.7	-
Atrevida Reef	9	5	265.3	5.9	-	118.8	8.3	105.0	13.8	-	-	-	-	-
Cape Cockburn	10	1	111.4	-	-	11.5	-	31.7	18.2	-	0.1	-	-	-
Cape Cockburn	10	3	52.1	-	-	-	-	1344.7	119.9	-	-	-	36.5	-
Cape Cockburn	10	5	258.2	-	-	-	-	2696.6	1520.4	-	-	-	38.2	-
Secret Cove	11	1	282.2	-	1.2	2.2	-	11.2	38.1	-	-	2.2	4.5	2.2
Secret Cove	11	3	541.9	-	-	-	-	9.0	24.0	-	-	-	-	-
Secret Cove	11	5	131.3	-	-	4.1	-	6.2	-	-	-	2.1	-	-

Table 7 continued…

Location	Tran	Stn	PPAR	SHRI	SIPH	TDIS	UCAL	UHAR
Clarke Rock	1	1	13.7	14.2	0.6	-	8.0	-
Clarke Rock	1	3	3.2	0.3	4.6	-	8.7	-
Clarke Rock	1	5	2.5	-	1.8	-	17.5	-
Yellow Point	2	1	20.2	13.6	39.3	-	100.8	-
Yellow Point	2	3	19.8	1.8	13.6	-	36.9	-
Yellow Point	2	5	23.6	11.1	20.0	-	124.8	-
Bowser	3	1	-	3.9	-	-	35.3	-
Bowser	3	3	92.1	8.3	18.7	-	56.7	-
Bowser	3	5	152.0	0.5	33.8	-	1224.8	-
Henry Bay	4	1	17.6	0.1	-	-	24.2	-
Henry Bay	4	3	108.2	22.7	2.9	2.6	20.8	-
Henry Bay	4	5	2.3	4.0	-	1.3	1.0	-
French Creek	5	1	34.5	7.1	0.2	-	5.7	-
French Creek	5	3	27.6	0.2	11.9	-	20.3	-
French Creek	5	5	16.8	2.3	2.3	-	144.1	-
Trincomali	6	1	12.4	6.3	-	-	8.3	-
Trincomali	6	3	-	7.9	0.1	-	7.9	-
Trincomali	6	5	4.6	0.4	-	-	8.4	-
Smelt Bay	8	1	17.2	42.9	31.4	-	-	-
Smelt Bay	8	2	36.3	5.3	9.8	-	131.1	-
Atrevida Reef	9	1	23.2	0.5	0.2	-	23.2	-
Atrevida Reef	9	3	2.7	0.2	-	-	5.4	-
Atrevida Reef	9	5	19.3	1.0	-	-	96.7	-
Cape Cockburn	10	1	6.7	2.9	13.7	-	7.7	-
Cape Cockburn	10	3	177.2	-	-	-	88.6	-
Cape Cockburn	10	5	9.6	0.2	29.1	-	67.4	9.6
Secret Cove	11	1	17.9	0.4	12.0	-	2.2	-
Secret Cove	11	3	80.8	4.0	15.3	-	39.3	-
Secret Cove	11	5	26.7	3.4	67.5	-	4.1	-